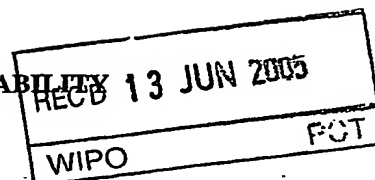


PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)



| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|---|-----------------------|-------------------------------------|-----------|---------------------|--------------------------|------------|----------|--------------------------|-------------|--|--------------------------|------------|----------------------------|-------------------------------------|-----------|---|--------------------------|------------|-------------------------|--------------------------|-------------|--|--------------------------|--------------|---|
| Applicant's or agent's file reference 03-1012-1B | FOR FURTHER ACTION | | See Form PCT/IPEA/416 | | | | | | | | | | | | | | | | | | | | | | | | |
| International application No. PCT/US04/15245 | International filing date (day/month/year) 14 May 2004 (14.05.2004) | Priority date (day/month/year) 17 May 2003 (17.05.2003) | | | | | | | | | | | | | | | | | | | | | | | | | |
| International Patent Classification (IPC) or national classification and IPC IPC(7): B29C 44/02, 51/02, C08J 9/00 and US Cl.: 264/50, 320, 321, 544; 521/51, 182, 79, 146, 180 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Applicant BRANCH, GREGORY L. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>2</u> sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p style="margin-left: 20px;">a. <input checked="" type="checkbox"/> (sent to the applicant and to the International Bureau) a total of <u>4</u> sheets, as follows:</p> <div style="margin-left: 40px;"> <input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. </div> <p style="margin-left: 20px;">b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>4. This report contains indications relating to the following items:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 10%;"><input checked="" type="checkbox"/></td> <td style="width: 20%;">Box No. I</td> <td>Basis of the report</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table> | | | | <input checked="" type="checkbox"/> | Box No. I | Basis of the report | <input type="checkbox"/> | Box No. II | Priority | <input type="checkbox"/> | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability | <input type="checkbox"/> | Box No. IV | Lack of unity of invention | <input checked="" type="checkbox"/> | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement | <input type="checkbox"/> | Box No. VI | Certain documents cited | <input type="checkbox"/> | Box No. VII | Certain defects in the international application | <input type="checkbox"/> | Box No. VIII | Certain observations on the international application |
| <input checked="" type="checkbox"/> | Box No. I | Basis of the report | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Box No. II | Priority | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Box No. IV | Lack of unity of invention | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Box No. VI | Certain documents cited | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Box No. VII | Certain defects in the international application | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Box No. VIII | Certain observations on the international application | | | | | | | | | | | | | | | | | | | | | | | | | |
| Date of submission of the demand 04 March 2005 (04.03.2005) | | Date of completion of this report 27 May 2005 (27.05.2005) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Name and mailing address of the IPEA/ US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230 | | Authorized officer Irina S. Zemel Telephone No. 571-272-0577 | | | | | | | | | | | | | | | | | | | | | | | | | |

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/US04/15245

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language _____, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:
- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1-27 as originally filed/furnished
- pages* NONE received by this Authority on _____
- pages* NONE received by this Authority on _____
- ☒ the claims:
- pages NONE as originally filed/furnished
- pages* NONE as amended (together with any statement) under Article 19
- pages* 28-31 received by this Authority on 04 March 2005
- pages* NONE received by this Authority on _____
- ☐ the drawings:
- pages NONE as originally filed/furnished
- pages* NONE received by this Authority on _____
- pages* NONE received by this Authority on _____
- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages _____
 - ☐ the claims, Nos. _____
 - ☐ the drawings, sheets/figs _____
 - ☐ the sequence listing (*specify*): _____
 - ☐ any table(s) related to the sequence listing (*specify*): _____
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages _____
 - ☐ the claims, Nos. _____
 - ☐ the drawings, sheets/figs _____
 - ☐ the sequence listing (*specify*): _____
 - ☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/US04/15245**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

| | | |
|-------------------------------|---------------------------|-----|
| Novelty (N) | Claims <u>1-11 and 13</u> | YES |
| | Claims <u>12</u> | NO |
| Inventive Step (IS) | Claims <u>1-11 and 13</u> | YES |
| | Claims <u>12</u> | NO |
| Industrial Applicability (IA) | Claims <u>1-13</u> | YES |
| | Claims <u>NONE</u> | NO |

2. Citations and Explanations (Rule 70.7)

Claim 12 lacks novelty under PCT Article 33(2) as being anticipated by JP 2001-40132 to Asahi Chem. The reference discloses a closed loop process for manufacture of foamed polystyrene comprising foaming raw polymeric material at low temperatures where the polystyrene contains 50-70 % of recycled polystyrene.

Claims 1-11 and 13 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest a closed loop process for manufacture of foamed polymeric materials comprising. impregnating mixtures of at least 5 % of recycled polymeric material and virgin polymer with foaming agent, decompressing impregnated mixture, foaming the mixture at temperatures above T_g but below T_m.

Claims 1-13 meet the criteria set out in PCT Article 33(4), and thus meet industrial applicability because the subject matter claimed can be made or used in industry.

NEW CITATIONS

JP 2001-40132 (Asahi Chem) 13 February 2001, see abstract

I. PhA/LLS

We claim:

- 1 1. A closed-loop method for the manufacture of foamed polymeric material, comprising:
 - 2 exposing an article of raw polymeric material at elevated pressure to a non-
 - 3 reacting gas which is soluble in the polymer for a time sufficient to achieve a desired
 - 4 concentration of gas within the polymer, thereby forming an exposed polymeric article
 - 5 which is at least partially gas-saturated;
 - 6 decompressing the exposed polymeric article;
 - 7 foaming the article at a temperature equal to or above the glass transition
 - 8 temperature of the gas-saturated article and below the melt temperature of the polymeric
 - 9 material; and
 - 10 trimming the foamed article to produce finished foamed polymeric material and
 - 11 scrap solid state process foamed polymer,
 - 12 wherein the raw polymeric material comprises 5% to 100% of any one of the
 - 13 group consisting of recycled pre-consumer polymer, recycled post-consumer polymer and
 - 14 scrap solid state process foamed polymer.
- 1 2. A closed-loop method for the manufacture of foamed polymeric objects, comprising:
 - 2 exposing an article of raw polymeric material at elevated pressure to a non-
 - 3 reacting gas which is soluble in the polymer for a time sufficient to achieve a desired
 - 4 concentration of gas within the polymer, thereby forming an exposed polymeric article
 - 5 which is at least partially gas-saturated;
 - 6 decompressing the exposed polymeric article;
 - 7 at least partially foaming the article at a temperature equal to or above the glass
 - 8 transition temperature of the gas-saturated article and below the melt temperature of the
 - 9 polymeric material; and
 - 10 forming and trimming the foamed article to produce foamed polymeric objects
 - 11 and scrap solid state process foamed polymer,

Amended Sheet

12 wherein the raw polymeric material comprises 5% to 100% of any one of the
13 group consisting of recycled pre-consumer polymer, recycled post-consumer polymer and
14 scrap solid state process foamed polymer.

1 3. A closed-loop method for the manufacture of foamed semi-crystalline polymeric
2 objects from an article of raw polymeric material, comprising:

3 exposing the article at elevated pressure to a plasticizing gas for a time sufficient
4 to achieve a desired concentration of gas, and to increase the level of crystallinity at the
5 surfaces, thereby forming an exposed polymeric article which is at least partially gas-
6 saturated, having a lower level of crystallinity in its core and a higher level of
7 crystallinity at the surfaces;

8 decompressing the exposed polymeric article;

9 at least partially foaming the article at a temperature equal to or above the glass
10 transition temperature of the gas-saturated article and below the melt temperature of the
11 polymeric material; and

12 forming and trimming the foamed article to produce foamed polymeric objects
13 and scrap solid state process foamed polymer,

14 wherein the raw polymeric material comprises 5% to 100% of any one of the
15 group consisting of recycled pre-consumer polymer, recycled post-consumer polymer and
16 scrap solid state process foamed polymer.

1 4. A method according to claim 1, claim 2, or claim 3, further comprising allowing
2 desorption of some of the gas from the surface of the article after decompressing the
3 article but prior to foaming the article.

1 5. A method according to claim 1, claim 2, or claim 3, wherein the temperature at which
2 the article is exposed to elevated pressure is sufficiently low and the pressure of non-
3 reacting gas to which the article is exposed is sufficiently high that the temperature at

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4 which foaming starts is below the glass transition temperature of the unsaturated
5 polymer.

1 6. A method according to claim 1, claim 2, or claim 3, wherein the temperature at which
2 the article is exposed to elevated pressure is sufficiently low to enhance the foaming of
3 the polymer, thereby reducing the density of the resultant foam.

1 7. A method according to claim 1, claim 2, or claim 3, further comprising reprocessing
2 substantially all of the scrap solid state process foamed polymer to make raw polymeric
3 material for further closed-loop manufacture of foamed material.

1 8. A method according to claim 3, wherein the temperature at which the article is foamed
2 is at or above that at which foaming occurs in the lower crystallinity core but below that
3 at which foaming occurs in the higher level crystallinity surfaces.

1 9. A method according to claim 2 or claim 3, further comprising applying additional heat
2 to the object at a temperature below the melting temperature of the unsaturated polymer
3 to raise the crystallinity level of the object.

1 10. A method according to claim 2 or claim 3, further comprising applying additional
2 heat to the object while it is still at least partially gas saturated to raise the crystallinity
3 level of the object.

1 11. A method according to claim 2 or claim 3, further comprising applying additional
2 heat to the object to raise the crystallinity level of the surface of the foamed object to a
3 level sufficient to increase the maximum operating or service temperature of the object.

1 12. A closed-loop method for the manufacture of foamed polymeric material,
2 comprising:

Amended Sheet

3 foaming raw polymeric material at a temperature below its melt temperature to
4 produce solid state process foamed-polymeric material, wherein the raw polymeric
5 material comprises up to 100% of any one of the group consisting of recycled pre-
6 consumer polymer, recycled post-consumer polymer and scrap solid state process foamed
7 polymer.

1 13. A closed-loop method for the manufacture of foamed polymeric objects from an
2 article of raw polymeric material, comprising:

3 reversibly plasticizing and at least partially gas saturating the article by exposing
4 the article at elevated pressure to a plasticizing gas for a sufficient period of time;

5 decompressing the exposed polymeric article;

6 at least partially foaming the article at a temperature below the glass transition
7 temperature of the unexposed polymeric material; and

8 forming and trimming the foamed article to produce foamed polymeric objects
9 and scrap solid state process foamed polymer,

10 wherein the raw polymeric material comprises 5% to 100% of any one of the
11 group consisting of recycled pre-consumer polymer, recycled post-consumer polymer and
12 scrap solid state process foamed polymer.